

CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

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RECONSTRUCTION OF MESSINA TELEMETERING EQUIPMENT

1. The German telemetering equipment reconstructed [] at NII 88 was the Messina I. [] a group of Germans, including Dr. MOSER and HINTZE, worked on the reconstruction of Messina II at Ilinskaya. 50X1-HUM
2. The Messina I was to be used with the A-4 missile to telemeter values such as rudder angle, pressures in the engine, acceleration vibrations, and turbine rpm. The original German equipment was modified in only one respect; i.e., to permit telemetering of values which are obtained from the inductance bridges, used to indicate pressures, vibrations, and accelerations. These values are in the form of 500 c.p.s. signals which must be rectified before they are fed into the modulator circuits. 50X1-HUM
3. The equipment operates as follows: four channels are continuously transmitted to indicate four measured values; four additional channels are used to transmit only 50X1-HUM

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instantaneous values at certain time intervals. The values to be transmitted are obtained either from induction bridges or from potentiometers. The voltage across the potentiometers is supplied by an accurately charged 2-volt storage battery.

4. The D.C. voltages indicating measured values control the output amplitudes of oscillators having frequencies between 2 and 10 kc. There is one oscillator for each channel to be transmitted. The transmitter is amplitude modulated by these oscillations. The transmitter uses a crystal controlled oscillator frequency of 20 or 21 mc, which is tripled for transmission at a carrier frequency of 60 to 62 mc.
5. The receiver on the ground includes a radio frequency pre-amplifier stage, a crystal-controlled local oscillator whose frequency is subsequently tripled, an IF amplifier, low frequency amplifier, automatic gain-control circuit, eight band-pass filters for the received channels of information, and a low frequency amplifier for each channel. The low frequency signals are then rectified and applied to two recording mirror oscillographs, each recording six values. In addition to the telemetered values, the oscillographs may record time marks, received signal amplitudes, times of command transmission, etc.
6. [redacted] the Messina I and II are the only foreign telemetering systems exploited by the Soviets. [redacted]
7. [redacted] one other telemetering system worked on in the USSR. This was to be a multichannel pulse system, presumably copied from a U.S. development. The project was secret, and it was not possible [redacted] to find out any further details.
8. The Germans did not have a code word generally applicable to telemetering equipment during World War II.

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SCR-584

9. [redacted] worked on a modification of the SCR-584, using the Doppler principle to measure velocity. [redacted]
10. The principles of operation of the modification are as follows: A 60 kc crystal-controlled oscillator feeds a frequency divider to produce pulses at a 3.3 kc repetition rate. These pulses are transmitted at a wave length of 10 cm and have a total duration of approximately two microseconds. The pulse is received and retransmitted by the missile. The returned pulse is received and detected by the SCR-584 receiver and triggers a 21 mc oscillator, which will run for the duration of the pulse. This oscillation is applied to one grid of a pentagrid converter.
11. The 60 kc crystal oscillator mentioned above also feeds a

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multiplier circuit which increases the frequency to 42 mc. This oscillation is continuously applied to another grid of the pentagrid converter. The plate circuit of this tube consists of an R-C network having a time constant of approximately two milliseconds. The relative phase of the two signals is thus indicated by the amount of plate current drawn during each pulse. As the missile being tracked changes position, the relative phase will change and the plate voltage of the converter varies gradually due to the long time constant. The frequency of the plate voltage variation is proportional to the velocity of the missile. For a missile velocity of 1500 meters per second this frequency will be approximately 500 c.p.s.

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12. [redacted] its most serious fault is the fact that a comparatively low noise level might be sufficient to start the 21 mc oscillator, which, of course, would make the velocity measurement worthless.

13. [redacted]
[redacted] the SCR-584 [redacted]
[redacted]

14. a. The frequency control circuits use two interchangeable quartz crystals at a frequency of approximately 40 mc. A frequency divider produces a pulse at a repetition frequency of between 2 and 4 kc, with a pulse length of 0.5 microseconds. A magnetron is used to generate the 10 cm wave length carrier.

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b. The antenna is a dipole rotating eccentrically at a rate of 10 to 15 seconds per revolution in a parabolic reflector 1.5 meters in diameter.

c. Direction finding is accomplished by amplitude comparison of the reflected pulse. The accuracy is plus or minus three minutes.

d. The range is measured by a coarse and a fine system, and presented on two cathode-ray tubes with a circular sweep.

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e. A PPI scope was also used, as well as a height finder.

f. An amplidyne system was used to drive the antenna.

15. [redacted]

16. [redacted] it will take at least two more years (i.e. until fall 1954) to have a working, usable SCR-584 modification for guiding antiaircraft rockets. However, if

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the government brings enough pressure to bear on the plants involved, a model may be produced earlier, which may be somewhat satisfactory in operation.

17. If the equipment were produced in the USSR, parts of it would probably be manufactured at Zavod 88, while most of the electronics parts might be built at one of the electronics plants at Gorkiy, Riga, Leningrad, or Novosibirsk.

PATH SIMULATOR (BAHNMODELL)

18. The path simulator was specifically designed for the G-1 modification of the A-4 missile. By substitution of the necessary coefficients, however, it may be used for analysis of other missiles as well as conventional aircraft. The simulator was an analog computer.
19. Until 1950 the models were made entirely of German components. After this date most components such as gyroscopes, vacuum tubes, measuring instruments, etc. were Soviet manufactured copies of the German parts.
20. No information on any other foreign computer developments were made available to the Germans working on this project.

DEVELOPMENTS OF THE 3000 and 6000-km RANGE MISSILES

21. Preliminary laboratory studies were made on these missiles in the wind tunnel and water canal. The latter was used primarily for analyzing the power plant to be used in the 6000km missile.

22. [redacted] 50X1-HUM

[redacted] the following data on the 3000-km missile. Fuel cut-off was to occur at a range of approximately 250 to 270 km. This would correspond to an altitude of between 150 and 200 km. [redacted] the thrust of the engine was fairly constant over the entire range, with a figure of about 150 metric tons. The initial acceleration was to be 2 g. The velocity at combustion cut-off was to be 3000 meters per second. The fuel to be used in this engine was alcohol and oxygen. [redacted] the cut-off altitude of the first stage [redacted] to be about 25 km.

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23. With respect to the 6000-km guided airplane, flight altitude was to be 25 km at a velocity of Mach 2. The first stage was probably to be cut-off at an altitude of 10 km. The fuel for the final stage was to be similar to turbojet fuel.

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24. As for the activity at Khimki, [redacted] power plants for rockets were developed there, and [redacted] a group of Germans had worked there but left the USSR before most other Germans

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[redacted] the second stage of the 3000-km missile might use such an engine.

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25. [redacted] work on these projects will be continued by the Soviets, but not too vigorously, since they will probably

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have great difficulties with this type of development.

DEVELOPMENT OF ANTIAIRCRAFT MISSILE

26. This missile was to employ a homing device and a proximity fuse, but no work was done on these items [redacted] 50X1-HUM
[redacted] flight characteristics of this missile, would be similar to those of the German Wasserfall, since the rocket is a modified Wasserfall. It 50X1-HUM
was to be launched vertically and captured in the radar beam between 300 and 400 meters above the site. The internal power for the missile was to be supplied by a battery and a 500-cycle generator.

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ANTENNAS

27. In addition to the antennas used [redacted] the following antennas were installed and used on the island: 1) Short-wave radio antenna (mast) on top of the main institute building above the location of the telephone exchange. 2) Dipole antenna installed on a turntable on top of the institute building above the high-frequency laboratories. This was used for testing antenna characteristics in conjunction with another dipole antenna mounted on a 28-meter-high tower, located 60 meters west of the building. 3) Miscellaneous radio receiver antennas. 50X1-HUM
28. In addition to the antennas listed above, [redacted] the following antennas in the USSR. 1) An antenna on top of the telegraph building in Moscow, probably used for short distance communications. This antenna consisted of four 90° sectors constructed of metal tubing and arranged to form a horizontal circle having a 4- to 5-meter diameter. 2) A short wave transmitter antenna (wave length 10 to 30 meters) consisting of wires strung between two towers 100 meters apart and 20 to 30 meters high. 3) Television transmitter antenna on top of tower in the Park Kultury in Moscow. 50X1-HUM
[redacted] The tower is 150 50X1-HUM
[redacted]

PERSONALITIES

29. The following persons [redacted] received new contracts to work in Moscow.
- a. Dr. Hans HOCH, a physicist. His speciality is control and guidance of missiles, with particular emphasis, in Germany and the USSR, on the path simulator (Bahnmodell).
 - b. Kurt BLASIG. He is a specialist in mechanical and hydraulic systems, particularly rudder actuation systems.
 - c. Alfons TOEFFER. Not an engineer, but an excellent mechanic and electrician. He worked primarily on construction of the Bahnmodell.
 - d. Hans VILTER. He worked for HOCH on Bahnmodell developments. 50X1-HUM

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e. Fritz WOLTER. A designer, he worked primarily for HOCH on Bahnmodell.

f. Dr. Felix STOLPE. He worked on the design of electronic parts of Bahnmodell with HOCH. His specialty is physics and electronics

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30.

31. General GONOR was head of NII 88 until 1950. His successor was RUDNOV. The periodical published by the "Institute fuer Mechanik und Automatik" may have included articles by or about these men to indicate their technical specialties and accomplishments.¹ This periodical is unclassified.

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GENERAL PROBLEMS AND PLANNING PROCEDURE IN GUIDED MISSILE DEVELOPMENT IN THE USSR.

32.

The Soviets did not indicate preference in any particular type of guidance system. For instance, the particular systems developed for the various projects were not suggested by the Soviets, but decided upon entirely by the German specialists. The same applies to the frequency of transmission to be used in the guidance system.

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33.

the production and development of electronic equipment

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34.

the Soviets' main problem in this type of work will be a shortage of good development and application engineers. There are a number of highly qualified theoretical scientists and mathematicians, but in copying and modifying existing designs the practical engineers are most important. Usually copies made by the Soviets are exact copies of the original equipment, including such factors as tolerances. In spite of this, problems are encountered in production methods. For instance it took approximately one year to manufacture exact copies of the German LD metal-ceramic tubes in production quantities. (The main difficulty was with metal-ceramic seals.) copies of American magnetrons, thyratrons, and cathode-ray tubes were of high quality from the start.

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35. In addition to the lack of practical engineers, difficulties will arise in Soviet developments due to the fear of failure. Since failure cannot be tolerated in the USSR, many engineers will hesitate to tackle difficult problems.

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36. [redacted] 50X1-HUM
[redacted] no Germans were employed in missile pro-
duction plants. [redacted] 50X1-HUM
37. Final testing of products manufactured on government orders is usually conducted by persons not employed by the manufacturing plant. These testers are very thorough, and will reject items for very minor reasons because later rejections would be a reflection on them. On the other hand, testing by plant personnel tends to be very lax, because the most important thing is meeting production quotas.
38. [redacted] persons from 50X1-HUM
NII 88 [redacted] included the Soviets RUBINOVICH, BUGAYEV, MARKOV, FOMIN, KRASNUSHKIN, and KRAYUSHKIN. [redacted]
[redacted] the missile program was 50X1-HUM
continuing along the same general lines at NII 88 [redacted]
39. [redacted]
40. [redacted] monthly and annual plans were made up by the 50X1-HUM
chief engineer, planning engineer, and sector leaders for each project. These plans would indicate the expected progress to be accomplished during the coming period.
41. Monthly progress reports were prepared by the sector leaders for each project. At the end of the year a large comprehensive progress report would be made up. [redacted] 50X1-HUM
[redacted] The annual 50X1-HUM
report was prepared by the sector leaders and translated into Russian by personnel of the "First Department".
42. At the completion of each project a complete report was written on it by the responsible German specialist. This was translated by personnel of the First Department, and proofread by the responsible German if he knew Russian, or by a Soviet scientist. The final report was typed in Russian by Mrs. CHERNOPYATOV, while the original German text was typed by Mrs. Ursula SCHAEFFER [redacted] or 50X1-HUM
Mrs. NEUMANN.
43. [redacted]
44. No particular distinction was made in the developments of ground and airborne equipment for missile guidance. [redacted] 50X1-HUM
[redacted] both developments were carried on in the same 50X1-HUM
group.

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45. [redacted] no developments [redacted] were considered complete failures. [redacted] velocity measuring modification of the SCR-584 was considered a failure since further development was dropped, and BUGAYEV, who took over [redacted] at NII 88, was later transferred. 50X1-HUM
46. To prevent countermeasures in command-type missile guidance systems [redacted] group depended on the directivity and power of the transmitted signal. 50X1-HUM
47. [redacted] 50X1-HUM
48. Initially, the Soviets used the original German names for electronic equipment taken over by them. Whether they later changed these names to Soviet designations is unknown. [redacted] the following names of German electronic equipment mentioned in the USSR: Messina, Honnef (cut-off command receiver), Victoria (azimuth-guided system), Michael (multi-channel 50-cm telephone communications), Wohlmann verfahren (velocity measuring method). 50X1-HUM
49. The shortest wave length [redacted] heard of in the USSR was 3 cm. [redacted] 3-cm magnetrons had been developed. The lowest radio frequency [redacted] was 150 kc. This was the frequency of a 400 kw broadcast transmitter in Moscow. 50X1-HUM
50. In servomechanism design, the tendency appears to be towards using amplidyne. These are of good quality, and are produced in large quantities, but it is difficult to obtain any for experimental work. [redacted]

COMPONENTS

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51. The following centimeter-radar components were observed by me in the USSR.
- a. Crystal detectors, type KD-2, which was an exact copy of U.S. detectors.
 - b. Tubes copied exactly from German types: LD-1, 6, 7, 9, 11, 12. The Soviet designations in Russian letters were the same.
 - c. [redacted] magnetrons or klystrons [redacted] are being manufactured in the USSR. These are probably exact copies of American types. 50X1-HUM

The following trade marks were noted on Soviet electron tubes:

- a. Letter "C" inscribed in circle.
- b. Pentagon - on LD type tubes.

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d. Elongated diamond [redacted] on test equipment.

e. [redacted] test equipment made at Gorkiy [redacted] noted a trade mark showing a lighthouse inscribed in a elongated diamond.

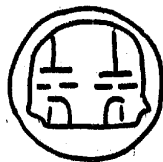
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f. [redacted] a delivery slip for LD-1 tubes made at Svetlana plant in Leningrad [redacted] noted a trade mark showing a double triode inscribed in a circle.

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1. [redacted] Comment. This institute is located in Moscow. Its correct Soviet title was not known [redacted]

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